EGG-KEEL NUMBER IN THE SMALL TORTOISESHELL BUTTERFLY

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In the past it was commonly believed that the peacock butterfly (*Inachis io* L.) had eight keels or setae on its eggs, while the small tortoiseshell (*Aglais urticae* L.) had nine (Brooks and Knight 1982). Döring (1955) stated that *I. io* had only seven such keels. In a survey of 53 egg batches in the Bollin valley, Cheshire, we found that in addition to both pure 8 keel and 9 keel batches, there were also combinations of the two with varying frequency. To investigate this further, samples of 10 to 20 eggs were taken from each batch, after they had been discarded by the larvae. The keels were then counted under x30 magnification, the results being illustrated in Figure 1.

As can be seen, most of the egg batches had a majority of eight keels, with a rapid fall-off to give only a few batches with a majority of nine keels. On the basis of Mendelian ratios for one gene locus, one would expect to get four combinations of phenotypes, assuming that eight keels are dominant to nine.

	Male		Female		Genotypes (Phenotypes)
1.	88	x	88	=	88 + 88 + 88 + 88 (100% 8 keels)
2.	88	x	99	=	89 + 89 + 89 + 89 (100% 8 keels)
3.	89	x	89	=	88 + 89 + 89 + 99 (75% 8 keels; 25% 9 keels)
4.	89	x	88	=	88 + 88 + 89 + 89 (100% 8 keels)
5.	89	x	99	=	89 + 89 + 99 + 99 (50% 8 keels; 50% 9 keels)
6.	99	x	99	=	99 + 99 + 99 + 99 (0% 8 keels)

We thus have 4 combinations of phenotypes. They are 100% 8 keels, 75% 8 keels, 50% 8 keels and 0% 8 keels (shown on Figure 1).

Certainly the frequency of eight keels runs true to the most typical combinations expected. They are numbers 1, 3 and 4. But, intermediate frequencies occur which need to be explained. There are several possibilities that could effect the final outcome. They are: (i) two different females of the same species laying their separate egg batches together on the same leaf; (ii) sampling effects, such that 10 to 20 eggs represent an inadequate fraction; (iii) different morality rates for specific keel genotypes prior to oviposition or during the egg stage; (iv) egg-keel number being controlled by more than one gene locus; (v) effects due to the environment.

These alternatives are unlikely to be equally feasible. Recourse to environmental influences or polygenic solutions, in practice requiring carefully thought-out experimental designs, pose usual

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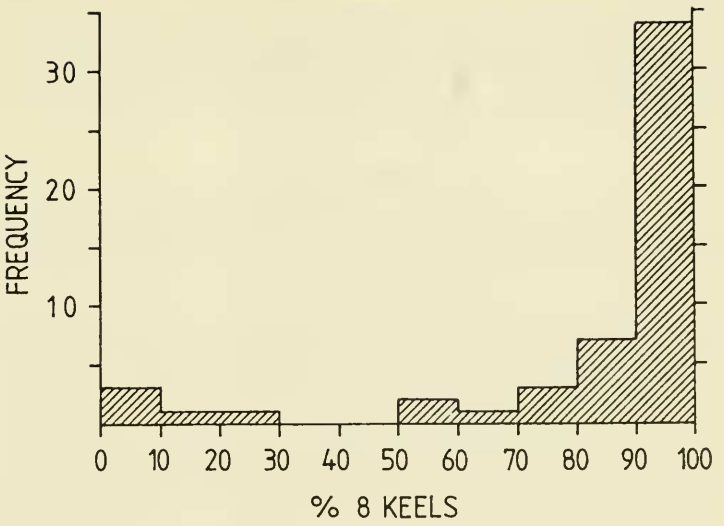

Figure 1. The frequency of *A. urticae* batches with different proportions of 8 and 9 keels from the Bollin valley, Cheshire, June 1983.

escape clauses, and can be made to 'model' real situations easily enough. Yet, effective practical treatments are rarely sufficiently rigorous and often difficult to establish. Differential mortality requires that we know the direct and associated functions of keel numbers, which we do not. On the other hand joint egg batches may account for some aberrant frequencies from expected single locus Mendelian situations. Baker (1978) has observed females return to oviposition sites to complete egg batches, and it is clear from the existence of egg clusters made up of sharply delineated adjacent egg masses of different ages that *A. urticae* has the ability to locate eggs on nettle beds and to add to batches (Dennis 1984). However, the most likely explanation of the deviant frequencies is the small sampling fraction used. The very nature of the small samples makes the calculation of the binomial standard error for these frequencies incorrect, but at very least some indication is given of how wide the confidence interval is likely to be:– for instance the 95% confidence limits for 8 keels is approximately 25 $\pm$ 19.4%, n = 20 in a batch comprising 25% eight keels to 75% nine keels.

As far as we know, this is the first time that dimorphism in keel number has been reported in single egg batches, and we would be interested to hear of any similar reports. There is also room for work on the genetics of the feature for those who regularly breed butterflies. An interesting additional point was the discovery of a peacock egg batch, identified later when the larvae had grown, which had been laid adjacent to and overlapping a small tortoise-

shell batch. When the two egg batches were examined under 600x magnification, no visible difference in the egg-shell walls between them could be found. The possible advantage to the peacock larvae of being laid next to a small tortoiseshell egg batch has been discussed elsewhere (Dennis 1984).

Acknowledgements

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References

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A FURTHER RECORD OF THE SPRING BROOD OF THE SCARCE CHOCOLATE TIP: CLOSTERA ANACHORETA D. & S. — A single male *Clostera anachoreta* was attracted to my m.v. trap at Lade, Lydd-on-Sea, Kent (TR0820) on the night of 27/28th May 1985. From comments on the note of C. W. Plant and P. A. Sokoloff (*Ent. Rec.* **96**: 211) it would appear that this is only the third example of a spring brood *anachoreta* caught in Britain. Its presence at Lade suggests that the species might be fairly widely distributed on the shingle area of Dungeness.

On the previous night, 26/27th May, single specimens of *Calophasia lunula* (Hufn.) and *Udea ferrugalis* (Hubn.) also turned up at the same site. I. P. WOIWOD, South Lodge, Cockayne Hatley, Sandy, Bedfordshire.

FEDALMIA HEADLEYELLA (STAINTON) (LEP: NEPTICULIDAE) IN DORSET — I was pleased to take a specimen of this local moth in my garden m.v. on 7th July 1985. This would appear to be a new vice county record for Dorset. (VC11). The larva feeds on selfheal (*Prunella vulgaris*), a plant which is abundant in my lawn! E. H. WILD, 7 Abbots Close, Highcliffe, Christchurch, Dorset.

ETHMIA BIPUNCTELLA FAB. IN EAST SUSSEX — I would like to record that at around midnight of 26 May 1985 I took a single example of this moth at m.v. in my garden. M. PARSONS, The Forge, Russells Green, Ninfield, East Sussex. [The only other Sussex *bipunctella* known to me is one taken at Peacehaven by F. Bickerstaff in 1952, which specimen I have. — J.M.C.H.]